Date _____

Expt. No. _____ Page No. 01

■ What is meant by Plumbing ?

It is the art of installing pipes, fixtures, tanks, water & sanitary connections and other apparatus in buildings for bringing in water supply and removing liquid and water carried wastes.

Plumbing includes supply and distribution of pipe fixtures and traps for solid waste, vent pipe for drain and sewer, storm water drain all with their devices and connections within and adjacent of the buildings.

● Tools used in Plumbing :

[1] Measuring tools : — a) Steel rule
b) Steel tape

[2] Marking tools : — a) Pencil c) Scriber
b) Chalk liner d) Punches

[3] Holding tools : — a) Pliers c) Pipe vice e) Bench vice
b) Clamps d) Pipe wrench

[4] Cutting tools : — a) Hack saw c) Chisels
b) Files d) Cutting machines

[5] Guiding and Testing tools : — a) Try square c) Plumb lead
b) Level

[6] Scraping and Grinding tools : — a) Scrapers
b) Grinders

[7] Threading tools : — a) Die c) Taps
b) Pipe vice

[8] Bending tools : — a) Hydraulic pipe bender

[8] Striking tools : — Hammers

[9] Fastening tools : — a) Screw driver
b) Pipe wrench

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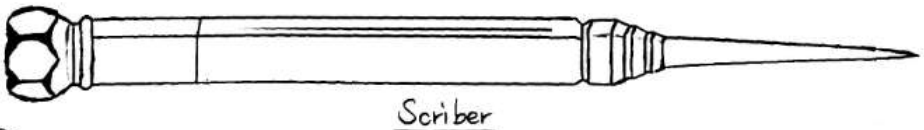
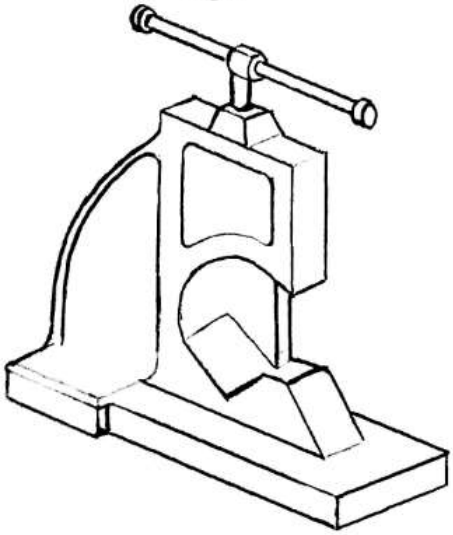
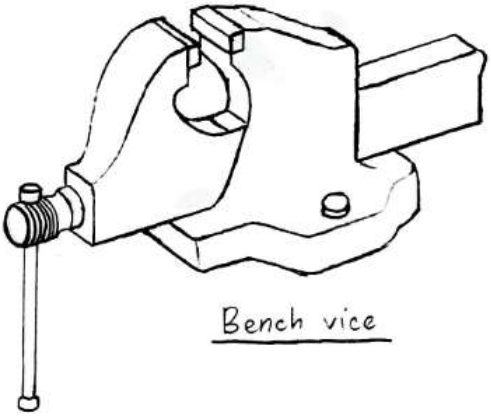


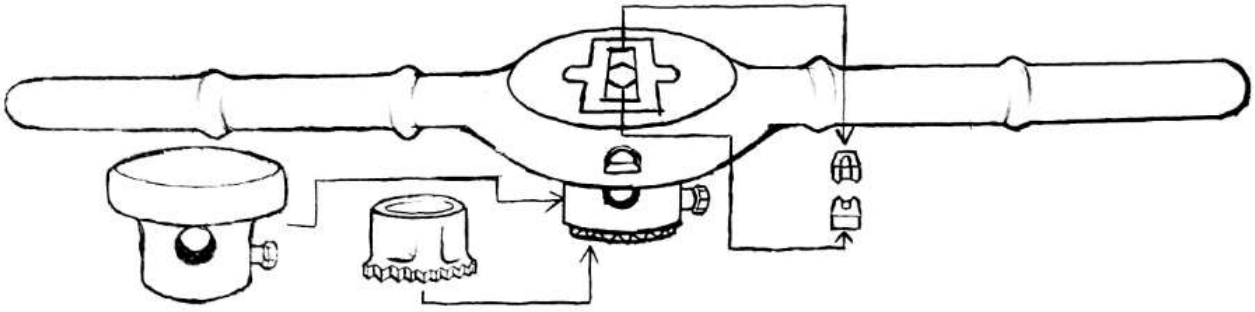
Scriber



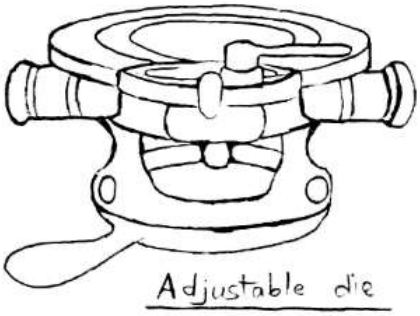
Pipe vice



Bench vice



Solid die



Adjustable die

* Scriber : Scriber is made of hardened tool steel having a sharp point, used to mark very fine lines. It is used in laying out fine works where wooden pencil mark will be too coarse for the required degree or precision. It's point can be removed for safe custody.

* Vices : Vices are used to hold pipes on place rigidly for cutting and other operations. The vices used by a plumber are generally of 2 types — (i) Bench vice
(ii) Pipe vice

The pipe vice is usually fixed on a bench, but for light work or to shift it to the site it is fixed in a portable frame. It has a fixed bottom jaw and an adjustable top jaw. The top jaw can be brought down to grip pipes, by means of a spindled screw.

Bench vice is bolted firmly on a bench and is used to grip materials in position for cutting, filing and other operations. It's behind jaw is fixed and the front jaw is adjustable and moved backwards to grip things in between by means of a spindled screw.

* Threading Tools :

1) Dies : Pipe threading dies are used to cut external threads on pipes, also called Stocks and Dies. There are 2 types of dies — i) Solid Stock and Dies
ii) Adjustable Stock and Dies

i) Solid die : Solid die consists of a steel die stock or frame with a handle at each end The dies are fitted into the centre of the frame, held in position by a block which is adjustable by means of Tommy bar. This stock cuts parallel threads and is not much employed as it's use is a labourious process. There is another drawback in this stock that whenever the dies are required to pull out it must run back the full length of the threads. At last, it needs separate set of dies for each pipe size.

ii) Adjustable die : The adjustable die consists of circular 4 adjustable dies with 2 or 4 lever handles held in the stock, where each set of die cuts a range of threads. There are self centering adjustable guides at front side of stock, to enable a square thread to be cut. It can also have ratchet lever handle for using in confined space. A catch or bolt is provided for quick release of the die and stock from the pipe without rotating it back. Pressure may be applied on the lever and bolt half to release burr from thread

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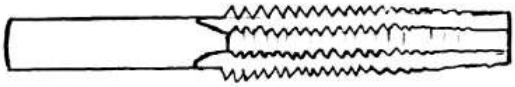
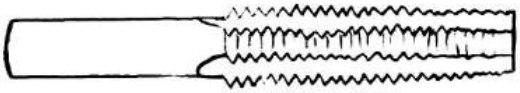
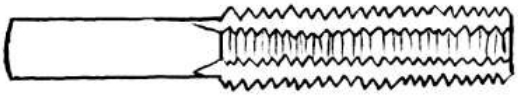
Taper tap

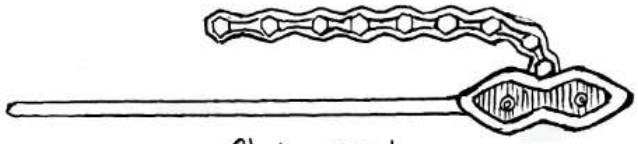


Plug tap



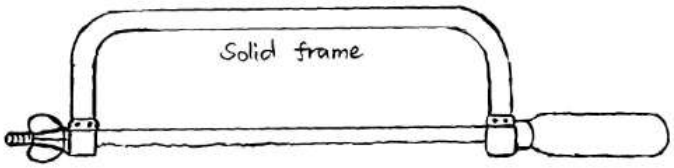
Bottoming tap



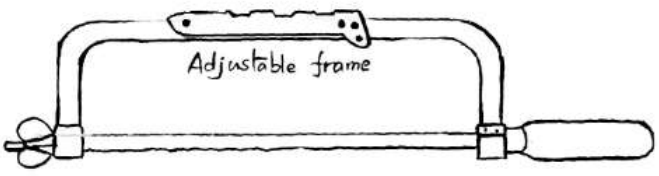


Chain wrench

Pipe wrench



Hacksaw



2) Threading taps: Taps are used for cutting internal threads on a pipe or fitting socket. It is made of high carbon steel, hardened and tempered. It's shank is made square to fit into a tap handle for turning. 3 taps are necessarily used step by step to cut threads —

a) Taper tap: Taper tap is used 1st which cuts light threads.

b) Plug tap: Plug tap is used 2ndly to make way for the thread depth.

c) Bottoming tap: Bottoming tap is used finally to cut the threads to required depth.

* Wrenches:

1) Chain Wrench: Chain wrench is a very efficient type of wrench, consisting of a gripping jaw fixed to a lever handle, with a strong chain attached at one side. The chain is passed round the pipe and secured by a catch at the other side of the jaw. As the tension or pressure pull is applied to the cutting jaw, it bites into the pipe and develops a good grip as pressure increases.

2) Pipe Wrench: It is also called Stilson wrench. It has a fixed bottom jaw attached to a lever handle and it's top jaw is movable and adjustable by means of an adjusting wheel. The inside of the wheel is cut teethes to enable it to engage with teeth of movable jaw. This wrench is available in different sizes.

* Hacksaw: Hand driven and portable power saw are used in plumbing work. The hand operated saw is named Hacksaw. It is loom shaped with a frame and a blade along with a handle. Hacksaws are of 2 types — with solid frame and with adjustable frame In a hacksaw, the blade is tightened in the frame by means of an adjustable wing nut till the blade is in full tension. It's blade is of high Carbon steel, properely tempered and may have teeth on 1 or both the edges directing opposite to the handle, so that the saw cuts when it is pushed away. The saw should not cut the inward stroke.

It is advisable not to use doubled sided blade on metal pipes as the other edge which is not cutting the metal will have the tendency to catch up the vibration making the saw unstable to cut.

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Date

Expt. No. _____ Page No. 04

- Pipes used in Plumbing

1] Galvanized Iron pipe
2] Cast Iron pipe
3] Copper pipe
4] Steel pipe
5] Lead pipe
6] Asbestos Cement pipe
7] PVC pipe

1] Galvanized Iron pipe: Galvanized iron pipes, called as G.I. pipes are frequently used in plumbing. The galvanization is process of coating Zinc on iron which prevents corrosion and gives strength. G.I. pipes should be treated for corrosion resistance after bending, because sometimes bending may crack the Zn layer and expose the inner iron.

2] Cast Iron pipe: Cast iron pipe is manufactured in different weight and lengths. When Cast iron pipe is selected for water supply or any particular service, the internal pressure and other stresses should be considered. The ends of cast iron water pipe are of 3 types-

i) Bell and Spigot standard end
ii) Flanged standard end
iii) Screwed standard end

i) Bell and Spigot ends are used mainly for the fittings and for caulking operations.
ii) Flanged ends are used in those buildings where space is limited. Here pipes are held together by bolts having gaskets between the flanges to make it leakproof.
iii) Threaded or screwed ends are used in small pipes in general practice although they are available in thicker pipes also.

3] Copper pipe: Copper pipes are used to carry hot water, corrosive liquids, for panel heating for cold water storage cisterns and hot water tanks. It's ductility allows for easy bending and fitting, can also be laid underground safely. It can't be used to carry alkaline liquids because of reactivity towards them. Copper fittings are not manufactured, instead partial brass, malleable iron, flanged cast iron etc are used. Nickel plated fittings can also be used for good appearance but it can sometimes wear off unevenly which gives very bad appearance. Therefore brass fittings are mostly preferred.

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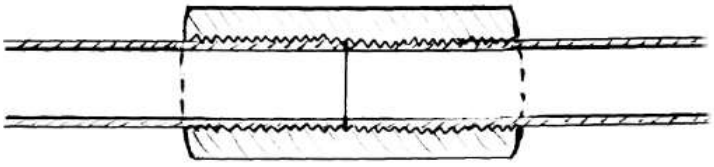
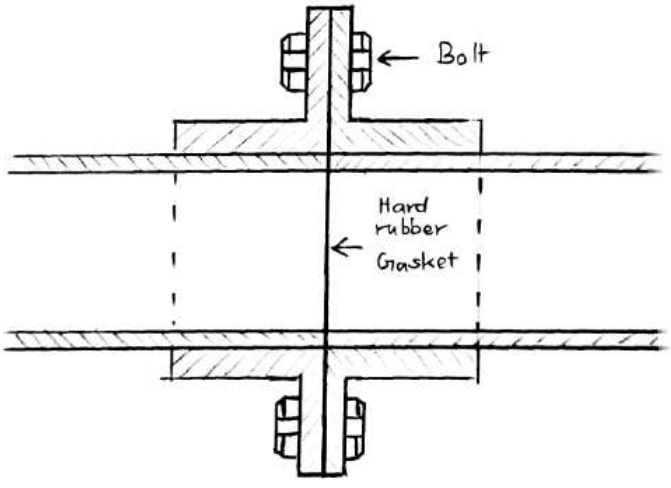


Screw and Socketed Joint



Flanged joint

Date

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Joints in Pipes

1] Screw and Socketed joint
2] Flanged joint
3] P.V.C. pipe joint
4] Bell and Spigot joint
5] A.C. pipe joints

Joints are essential for joining various pieces of pipes in order to make one continuous length of pipeline. The design of joint depends upon type of the pipe, internal water pressure, external and internal temperature, support conditions etc. Some of the joints are described below -

1] Screw and Socketed joint : It is a simple joint commonly used for connecting Galvanized Iron pipes together, where ends of the pipes are provided with threads on external surface, joined with each other by inner threaded sockets by screwing or fastening.

In order to make the joint watertight, a suitable joining adhesive like solvent cement or teflon tapes are placed in the threads of the pipes before screwing socket over it.

2] Flanged joint : Flanged joints are used for cast iron pipes, steel pipes when water pressure is high. Flanges are bolted between the joining pipes after putting a rubber gasket in between.

This joint is very simple where it's casted as a part of cast iron pipes but it is riveted or welded in case of steel pipes.

This types of joint should not be used at those places where pipes face instability or vibrations.

Different types of thread standards

1) British Standard Pipe thread (B.S.P.)
2) British Standard Fine thread (B.S.F.)
3) British Standard Associated thread (B.S.A.)
4) British Standard Whitworth thread (B.S.W.)

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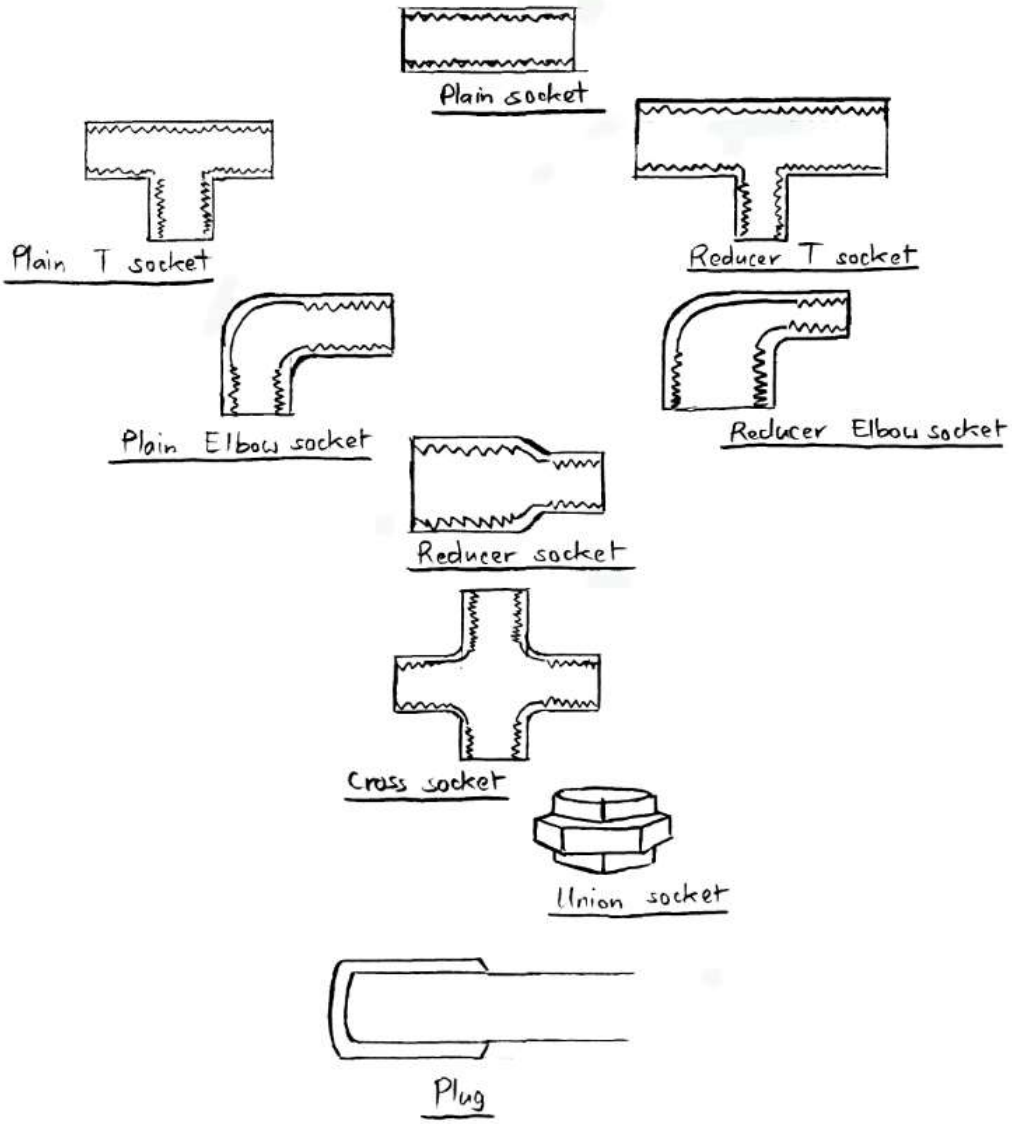
Plain socket
Plain T socket
Reducer T socket
Plain Elbow socket
Reducer Elbow socket
Reducer socket
Cross socket
Union socket
Plug

Date _____

Expt. No. _____ Page No. 06

Different types of Socket and Pipe Fittings

Pipe fittings are used to join adjacent lengths of pipes or to provide changes to to perform certain operations. These can be of various materials as pipes are. Types of pipe fittings are — 1] Sockets and different joints 3] Valve 5] Water tap etc
2] Plug 4] Traps

1] Sockets :

a) Plain Socket :

It is used to connect 2 pipes of same diameter.

b) T-Socket :

It is used to connect a branch pipe at main pipeline. It can be equal sizes or reducing size.

c) Elbow Socket :

It is used to connect pipes at right angles when 1 pipe is not bent for the purpose. It can be of equal size or reducing size.

d) Reducer Socket :

It is used to connect 2 pipes of different diameters.

e) Cross Socket :

It is used to connect 4 pipes at right angles to each other, may be plain or reducing.

f) Union Socket :

It is used to connect 2 pipes in such manner so that they can be disconnected easily when desired.

2] Plug :

It has external threads so that it can be fastened in a pipe end which has internal thread. It is used to close a pipe opening which is left further use. Sometimes it is used with a T or Cross Socket.

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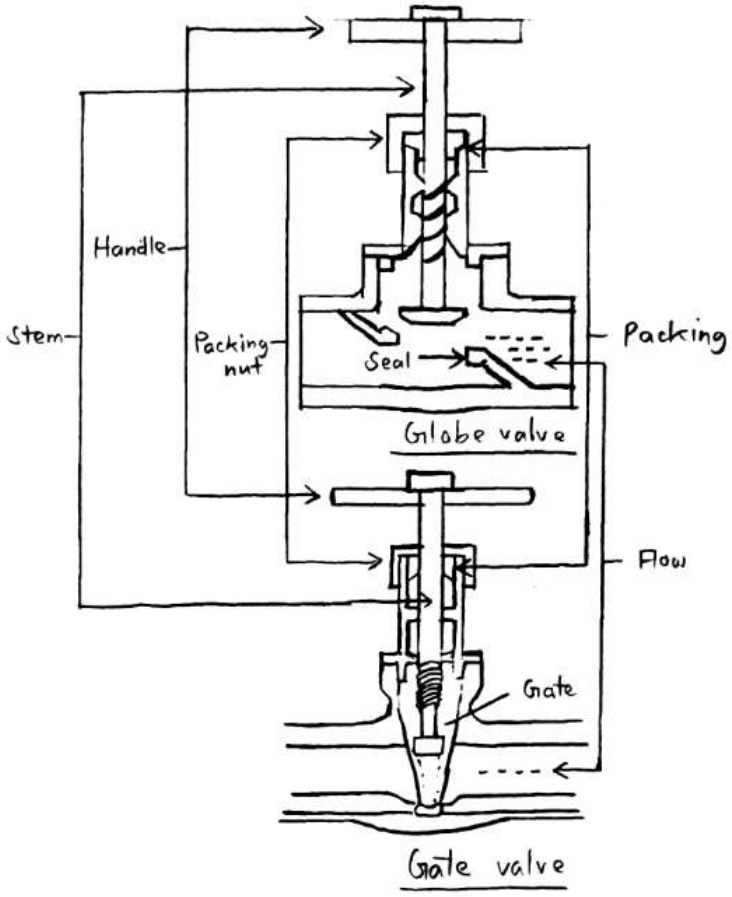
Handle
Stem
Packing nut
Seal
Packing
Globe valve
Flow
Gate
Gate valve

3] Valve:

Valve is a device used to control the passage of liquid in a pipe. Its types are —

a) Globe Valve: Globe valve is used to shut off water supply, also used for meter valve and main shut-off valve, generally to control or reduce the supply. In a globe valve water must take 2 right angle turns when passing making a significant pressure drop. So, a globe valve offers a considerable amount of resistance to water supply.

b) Gate Valve: Generally gate valve is not used in home plumbing because it's neither half open nor half close. Here, flow can not be reduced and if it is tried to, then the valve will vibrate and tear off quickly. Gate valves are used as shut off valves where main supply line enters the basement after the meter.

c) Check Valve: Also called Reflex valve or Non return valve, a Check valve is an automatic valve which allows the water to flow in only one direction and prevents it from flowing backwards. It consists of a flat disk or door within the pipeline, pivated so that it is forced opens when water flow is in the required direction and forced shut against a gun metal seating when water flow tries to reverse. It will be observed that the seating is normally arranged slightly out of perpendicular because it enables the disk to close automatically by gravity when there is no flow in the valve.

It is necessary for the Check Valve to be placed in every pipeline through which water is forced by a pump, so that if pump stops, water can not run back to the pump. Because if water runs back to pump in reverse direction, the meter connections of the pump may damage.

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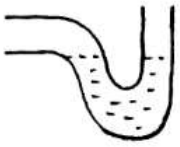
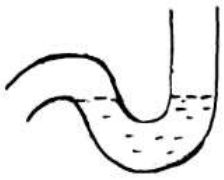
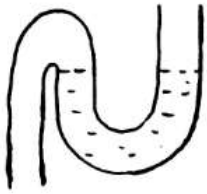


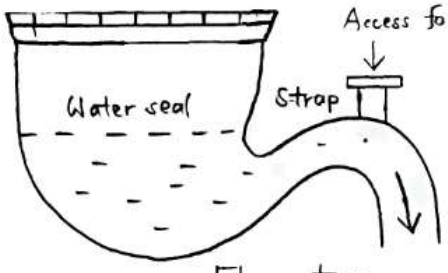
P trap



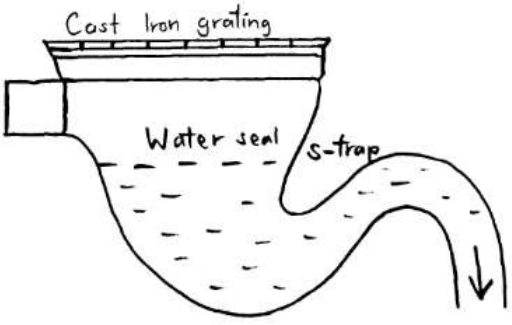
Q trap



S trap



Floor trap



Gully trap

Date _____

Expt. No. _____ Page No. 08

4] Traps :

Traps have been defined as fittings placed in drainage pipes, which allow liquid flow in one direction if it's in certain speed; and prevents foul air, gases passage to run backs in reverse through drains, waste or soil pipes to house or building interiors. This is possible because traps are equipped with water seals having a depth of 25-75 mm, 50 mm depth being common. Depth of water seal ensures effectiveness of the trap, so greater the depth, more useful the trap is in practice.

Traps may be classified in 2 ways —

a) According to their shape
   i) P-trap
   ii) Q-trap
   iii) S-trap

b) According to their particular use
   i) Floor traps
   ii) Gully traps
   iii) Intercepting traps

* Floor trap : These are used primarily for admitting surface waste or waste water from floors of bathrooms and kitchens. These are invariably provided with cast iron grating at top to exclude coarse solid matter to prevent it from passing into drain along and thereby causing blockade. A form of floor trap much used in practice is the Nahmi trap.

* Gully trap : Also called Gullies, these are used for the reception of sullage from baths, wash basins as well as rain waters. The waste pipes or the rain water pipes discharging into drains are seldom connected to them without such interception. Gully traps may have P-trap or S-trap and depth of 50-75 mm. The upper section of the trap is covered by a Cast Iron grating to exclude coarse solid matter earlier.

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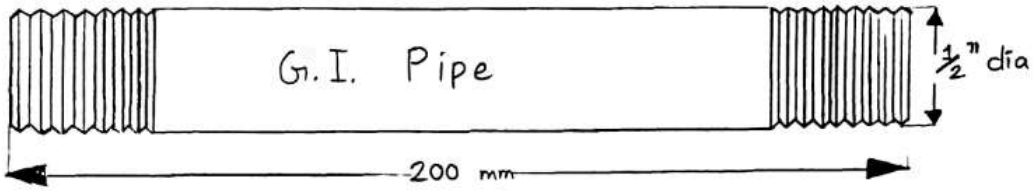
G.I. Pipe
½" dia
200 mm

Date _____

Expt. No. 1 Page No. 09

Job No. 1 : Short Nipple

Material used : Galvanized Iron pipe (G.I.)

Diameter of the pipe : 1/2"

Name of thread : British Standard Pipe thread (B.S.P.)

Type of thread : V shaped

Angle of thread : 55°

Tools required :
- i) Steel rule
- ii) Chalk or pencil
- iii) Scriber
- iv) Pipe vice
- v) Hack saw
- vi) Bench vice
- vii) Try square
- viii) Flat file
- ix) Die

Operations :
- i) Measuring
- ii) Marking
- iii) Holding
- iv) Cutting
- v) Filing
- vi) Testing
- vii) Threading
- viii) Finishing

Procedure :
i) The G.I. pipe is measured to required length and marked, cut by hacksaw while gripped by pipe vice.
ii) Both ends of pipe are filed to smooth edges while gripped by bench vice.
iii) Threads are cut on the both ends of the pipe by a die rotating it again and again to required length while holded by pipe vice.

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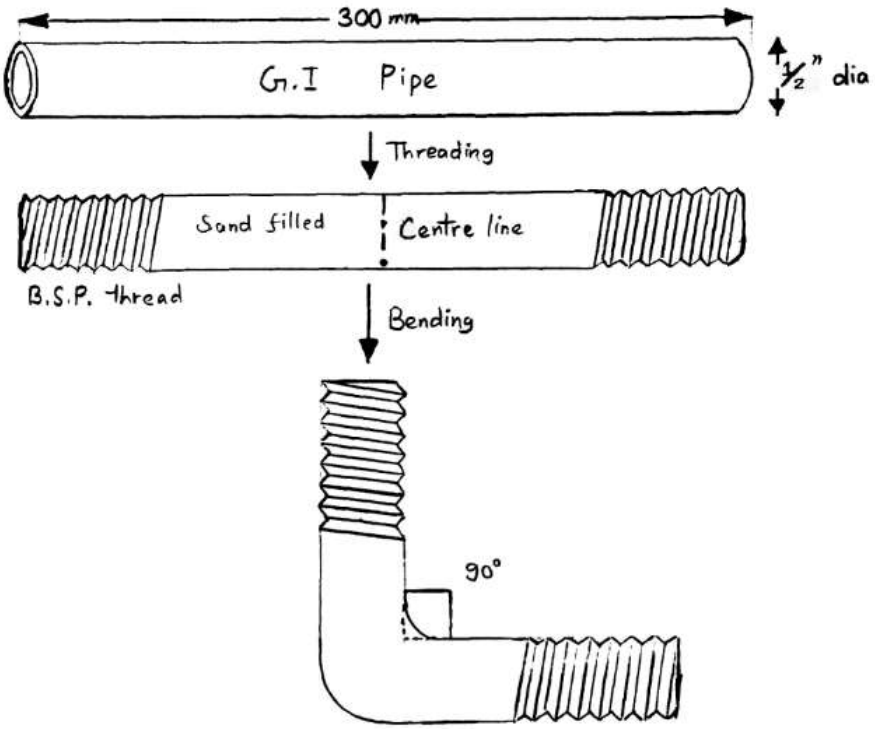

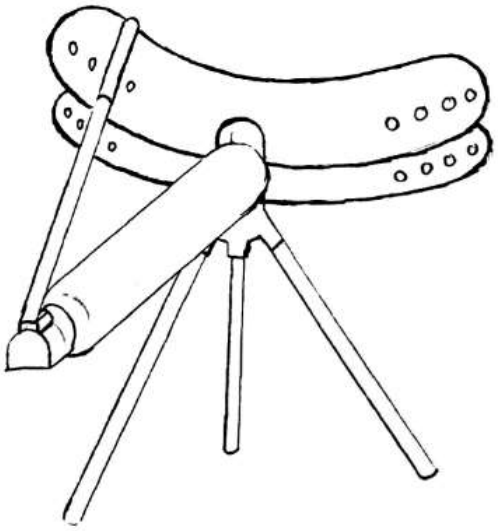

Pipe bending machine

Date _____

Expt. No. 2 Page No. 10

Job No. 2 : Pipe Bending

Material used : Galvanized Iron Pipe (G.I.)

Diameter of the pipe : 1/2 inch

Name of the thread : British Standard Pipe (B.S.P.) thread

Type of thread : V shaped

Angle of the thread : 55°

Tools required : i) Steel rule, ii) Chalk or pencil, iii) Scriber, iv) Pipe vice, v) Hacksaw, vi) Bench vice, vii) Try square, viii) Flat file, ix) Solid die, x) Pipe cutter, xi) Pipe wrench, xii) Chain wrench, xiii) Hydraulic Pipe Bending machine

Operations : i) Measuring, ii) Marking, iii) Holding, iv) Cutting, v) Filing, vi) Testing, vii) Threading, viii) Bending

Procedure :

i) The G.I. pipe is measured by steel rule to required length and marked by chalk, pencil or Scriber, cut by hacksaw while holded by pipe vice.

ii) Both ends of the pipe are filed to smooth edges while gripped by bench vice.

iii) Threads on the both ends are cut by fitting into solid die and rotating it again and again to required length while holded by pipe vice.

iv) The pipe is filled with sand and the 2 ends are closed, then it is fitted in the pipe bending machine, hydraulic is then pumped by the handle until the pipe is bent to 90°

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